

EXHIBIT 25

CMOS SOI RF Switch Family

Application Note 307

Industry: Communications

Primary Applications: Wireless Communications

High Performance RF Switches Introduction

Honeywell has developed a line of highly integrated, low cost RF CMOS SOI (Silicon-On-Insulator) switches with integrated digital, mixed signal and RF functions. CMOS SOI technology provides the performance of GaAs with the economy and integration capabilities of conventional bulk CMOS. These switches are ideal for use in a wide range of wireless applications that require accuracy, compact package and low power consumption. These devices were developed for use in cellular, PCS (Personal Communications Service) and GSM (Global System for Communications) base stations, handsets and 2.4 GHz WLAN (Wireless Local Area Network) applications.

CMOS SOI switches are manufactured using a high yield silicon process for superior integration of RF, passive and digital functions. Each chip incorporates active MOSFET transistor devices for RF, digital and mixed signal functions.

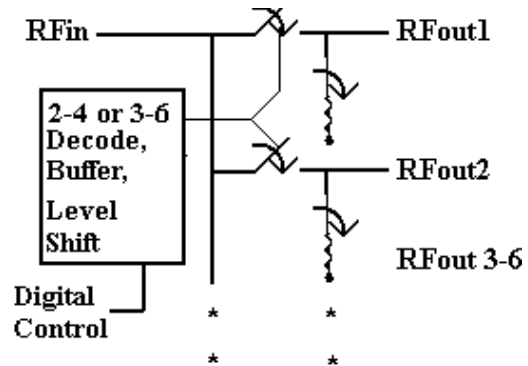
CMOS SOI Switch Features

- Integrated logic and drivers
- Very low DC power consumption
- High channel to channel isolation
- Space saving LPCC™ surface mount packaging
- Single supply operation
- Dual power supply configuration for improved linear RF power handling capability
- ESD Protected Digital Control Inputs
- 50 and 75 Ohm matched impedance

Benefits

- Simplified CMOS digital interface
- Reduced board space
- Manufacturing cost savings
- Mature technology
- Volume production base

Functional Schematic



Descriptions

RF Path The active RF path is composed of active microwave switch FET's that are selected by the appropriate digital control networks. The network is designed as non-reflective to maintain the 50 or 75 ohm output load for OFF paths to provide the best return match.

Digital Interface The digital interface circuits (shown on pg.3) use simple combinational logic to minimize the number of control inputs. All inputs are CMOS levels. They are buffered to assure accurate levels, ESD protected, and level shifted to follow the VSS level if chosen to be other than ground.

P1dB Level shifters This device has an optional configuration to widen the linear range for higher power levels. With the VSS pin wired to default ground, this product has a P1dB in the low 20's dBm (refer to electrical specifications). With the VSS wired to a negative supply (up to -5 volts) proportionally 7 dB - 10 dB additional RF power can be applied prior to the P1dB compression point.

Complimentary Switch Products

Listing	Description
HRF-SW1000	DC-4GHz SPDT-50 ohm
HRF-SW1001	DC-3GHz SPDT-75 ohm
HRF-SW1020	DC-2.5GHz SP4T-50 ohm
HRF-SW1021	DC-2.5GHz SP4T-75 ohm
HRF-SW1030	DC-2.5GHz SP6T-50 ohm
HRF-SW1031	DC-2.5GHz SP6T-75 ohm

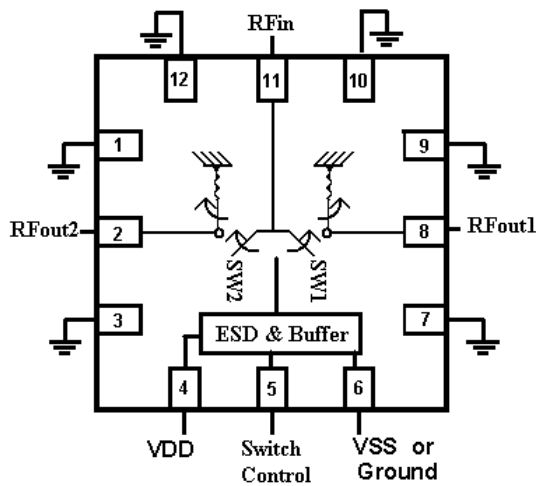
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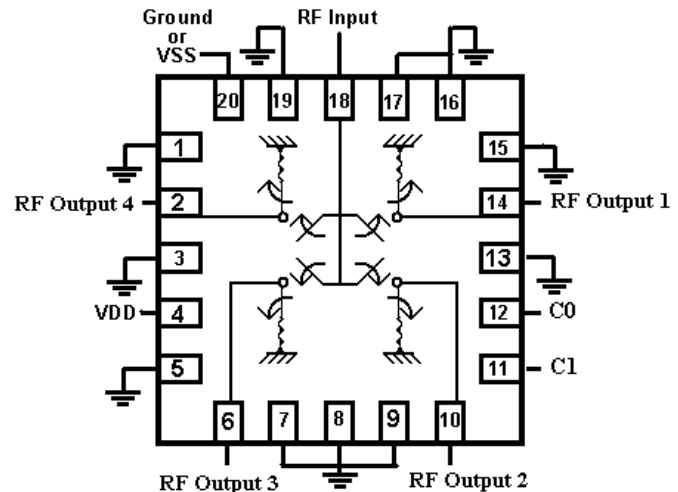
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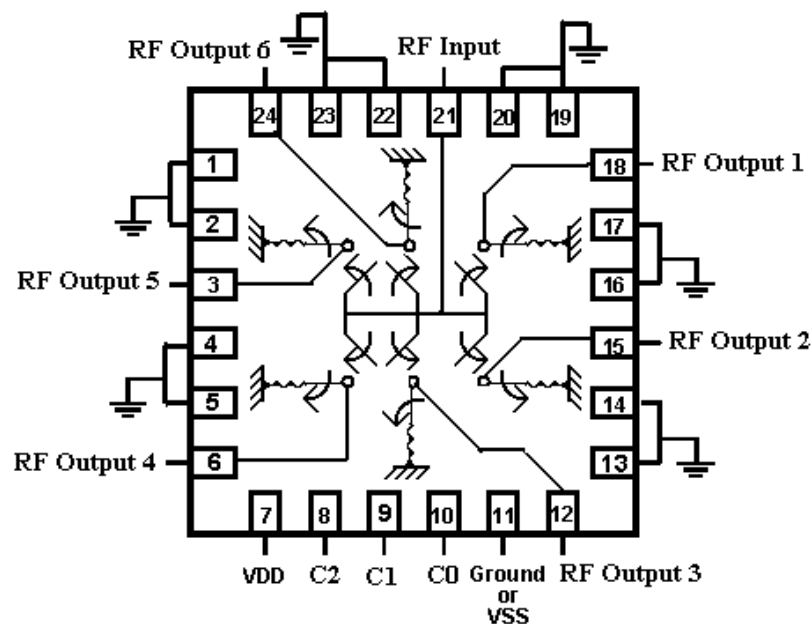
Typical Application Circuits

HRF-SW1000 & HRF-SW1001 SPDT Switches

Top View
Note: Back plane must be grounded

HRF-SW1020 & HRF-SW1021 4 T Switches

Top View
Note: Back plane must be grounded

HRF-SW1030 & HRF-SW1031 6 T Switches

Top View
Note: Back plate must be grounded

Application Summary

Single and Dual Power Supply Options

(P1dB) This device is designed to allow the choice of using either a single (VDD = +5 volts, and VSS = Ground) or dual voltage supply (VDD = +5 volts, and VSS = negative supply up to -5 volts). As noted on the electrical specification, the P1dB compression point is extended in the latter case by 7 dB to 10 dB proportionally to the negative supply value. Very little current is required by the VSS negative supply pin (μ amps). CMOS swings between VDD and ground are maintained for all digital interfaces. RF inputs can be DC coupled, swinging around ground.

DC RF Interface This device is designed for DC coupling of the RF swing around ground. No blocking caps are needed so the device is truly DC operational. AC coupling is allowed and could be used to block non-ground centered signals. In the AC case, the cap value determines the low frequency cutoff.

Package Related Optimization The 50 ohm or 75 ohm RFin/RFout conductor paths should be maintained within close proximity of the package. A ground plane for ground pins and the RF backside ground plate should be employed. The low inductance ground path of the backside ground plate is required for rated performance.

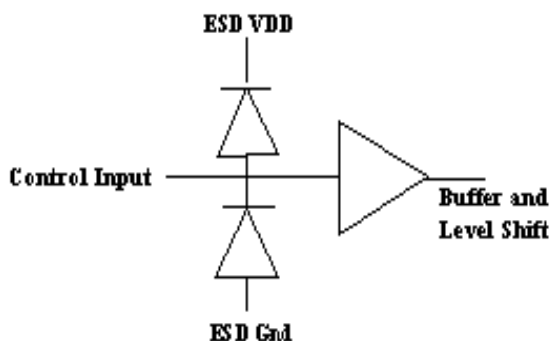
High Channel/Channel Isolation This family of switch products has state of the art, channel to channel isolation. This isolation is maximized across the frequency band, and is unmatched within the industry with this economy.

Electrostatic Discharge (ESD) Protection

RF circuits are traditionally difficult to protect without severely impacting performance. The integration capabilities of SOI technology allow the more ESD sensitive nodes to be kept internal to the chip, where they can be protected by the digital interface circuitry. Digital control inputs (Cx) are protected with ESD diodes to each supply, typically withstanding greater than 1K volts, human body model. (See drawing this page) RFin/RFout ports can not be protected as effectively, therefore they should be handled following special ESD procedures. The large source/drain areas of the Rfin/out pins add some protection achieving the value specified in the "Absolute Ratings" table.

Digital Logic Decoding Although the SPDT's have a simple inverter/buffer single line control, the 4T and 6T employ a 2-to-4 and a 3-to-8 decoding scheme, respectively. In the 4T, all codes are used, so one switch is enabled at all times; in the 6T, codes 1 through 6 are used with code "zero" and code "seven" putting all switches in the "OFF" state.

Typical Digital Control Circuitry:



Notes:

Additional Information

In addition to standard attenuator and switch products, Honeywell also provides "My SOI Foundry Services" and customized options: "My SOI Designer", "My SOI Test", and "My SOI Packaging". Honeywell designers can also convert GaAs-based designs into CMOS SOI-based devices.

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